

## Do we need a multiplier to perform an MPPT controller?

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This Design Idea is just an idea, because I didn't build a prototype. I've just read the nice article 'Solar-array controller needs no multiplier to maximize power', by W. Stephen Woodward (EDN Europe, 1 2009, pgs. 38-40). The title emphasizes the possibility to avoid using a multiplier to perform an MPPT control, even if some kind of "hidden" multiplier is still used into the circuit. It is possible to build an MPPT without using multipliers at all. A multiplier is necessary if we decide to limit our MPPT input to the source electric parameters, but is not necessary if we consider measuring the power on the load.

If we are not in presence of a strange exotic load, current generally grows with the voltage, and we get the maximum power when the output voltage is maximum. In case of resistor load we have simply

$$W = V^2 R \quad \text{or} \quad W = \frac{I^2}{R}$$

Since we are very smart designing buck converters we may assume the power on the load is the power supplied by the panel; so getting the maximum voltage at the output means getting the maximum power transfer.

The following model (fig.1) simulates a power source (a DC generator with an internal resistor), where an MPPT tries to maximize the output voltage controlling an ideal power transfer device.

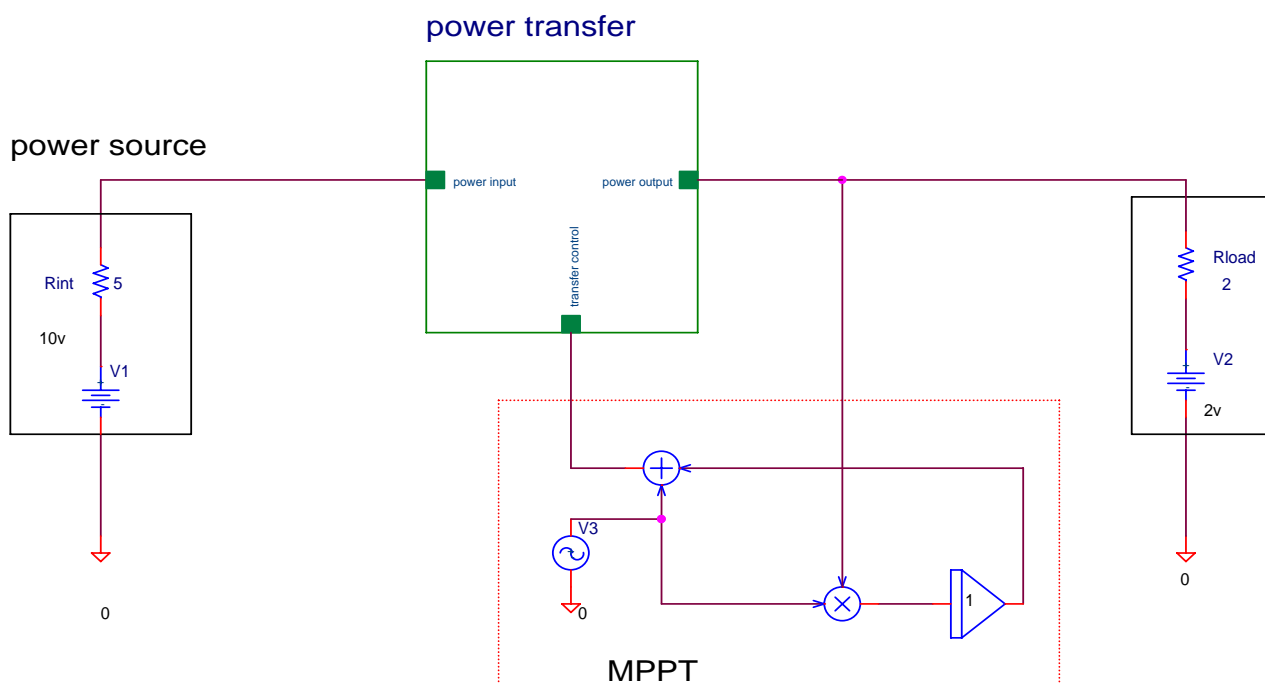


Fig.1 - A power source (constant voltage with a series resistor) is connected to a load (battery to be charged) through an ideal power coupler. The MPPT block operates the power transfer to maximize the output voltage.

The power transfer block models an ideal buck converter where:

$$W_{input} = W_{output} \quad V_{output} = V_{input} \cdot V_{control}$$

$$0 \leq V_{control} \leq 1$$

$V_{control}$  is the signal supplied by the MPPT.

The MPPT block is an extremely simple ‘perturb-and-observe’ type; the perturbation signal (from the oscillator V3) is superimposed to a synchronous detector output (multiplier and integrator) and controls the power transfer block.

Fig. 2 shows the behavior of the power source when we operate the MPPT. The continuous trace is the Voltage vs Power diagram of the generator (10 V with a 5 Ohms series resistor), the red squares are time equally spaced samples of the MPPT climbing the power hill.

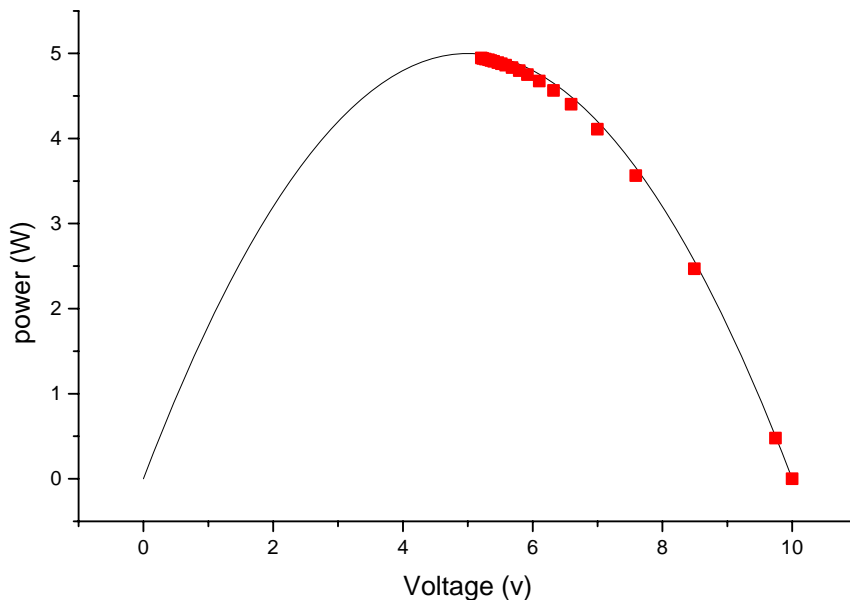


Fig. 2 - The generator power curve (black trace) ‘climbed’ by the multiplierless MPPT (red squares).